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S E M I N A R

aus

Halbleiterphysik und Nanotechnologie

Di, 21.6.2011, 11 Uhr c.t.
Hörsaal für Physik

"Resonantly enhanced absorption in photonic crystal slab quantum well infrared photodetectors"

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Photonic crystals (PCs), structures with a periodic modulation of the refractive index, exhibit fascinating properties for the control of light. Most existing devices are realized as two-dimensional (2D) PCs, as their processing is compatible with standard semiconductor technology. Confinement of photons in the out-of-plane direction can be achieved by combining a PC with a dielectric slab wave guide, resulting in a so called photonic crystal slab (PCS). By fabricating a PCS from a photosensitive material the resonant modes can be directly measured in the photocurrent spectrum of the device.
For detection of light in the mid-infrared region (MIR) we use a quantum well infrared photodetector (QWIP) as active material for PCSs. At the resonance frequencies of the PC the lifetime of the photons is increased, which increases the photon absorption. Therefore, a lower doping concentration in the quantum wells of the active zone can be used. With a lower doping concentration the thermal noise is reduced and maximum operation temperature can be increased.
PCS-QWIP devices are also well suited to obtain a deeper understanding of the optical properties of PCs. The most important property of PCs is the photonic band structure, which we calculate using the plane wave expansion method (PWEM) and the revised PWEM (RPWEM). Comparison of the calculated band structures shows very good agreement with peaks in the measured photocurrent spectra of fabricated PCS-QWIP devices.